

JAN 28 2003

TECHNOLOGY CENTER 2800

B1  
Cond

several seismic traces; determining the similarity between the selected reference section and localized sections of seismic data from the measurement data set; creating a volume of data which corresponds to the measurement data record, using the similarity value which has been determined and allocated to each data point as the attribute. During processing of the seismic data, the sub-surface images are able to be classified by an absolute comparison of the measurement data with a reference sample section as the means of interpretation.

---

A marked-up copy of the prior pending Abstract showing the changes made is attached hereto as Exhibit A.

IN THE SPECIFICATION:

Page 1, before line 1, please delete "Description".

Page 1, before line 1, please insert the following heading:

-- BACKGROUND OF THE INVENTION --

Page 1, before the first full paragraph, please insert the following heading:

-- 1. Field of the Invention --

JAN 28 2003

TECHNOLOGY CENTER 2800

Page 1, after the first full paragraph, please insert the following heading:

-- 2. The Prior Art --

Pages 3-4, for the paragraph bridging pages 3 and 4, please substitute the following paragraph:

B2  
Cont

--A method for seismic data processing is known from WO 96/18915. In this method, a seismic 3-D volume is divided in a multitude of horizontal slices, which are vertically disposed one on top of the other and spaced from each other, whereby at least one slice is divided in a multitude of cells. In this connection, each cell comprises at least 3 portions of traces whereby the first and the second trace portions are arranged in a vertical plane in the direction of the profiling (= inline), and the third trace portion and the first trace portion are arranged in a vertical plane substantially perpendicular to the direction of the profiling (= crossline). A cross correlation is then carried out between each two trace portions in the two vertical planes. Such a cross correlation supplies inline and crossline values that are dependent on layer dip. Combination of these values in a cell yields a coherency value for the cell that is

## TECHNOLOGY CENTER 2800

assigned to a data point of the cell. The final result in turn is a 3-D data volume from which any desired sections can be extracted and displayed.--

Page 4, for the first full paragraph, please substitute the following paragraph:

B2  
Cond.

--A method and a device for seismic data processing by means of the coherency characteristics are known from EP 0 832 442 A1, whereby in a manner similar to the method of the patent cited above, a seismic volume is divided in horizontal slices and the latter in turn are divided in cells. The cells have the shape of cubes in the simplest case. Based on the trace portions present in the cells, which amount to at least two in each cell, a correlation matrix is formed as the sum of the differences between inner and outer products of the sets of values from the trace portions. The quotient formed by the highest Eigen value of the matrix and the sum of all Eigen values is then calculated as the measure for the coherency. The result is again a 3-D volume comprised of coherency values.--

---

## TECHNOLOGY CENTER 2800

Page 5, for the first full paragraph, please substitute the following paragraph:

B3  
Gmk

--Furthermore, a method for determining physical properties of the subsurface is known from EP 626 594 A1. In this process, a comparison is carried out between a seismic reference trace recorded at a well location and a reference trace obtained synthetically from log data of a well. Modified synthetic seismograms are subsequently generated that are compared with the other seismic traces. However, only two trace segments are compared to each other, namely one trace segment of a seismic trace and one trace segment of a synthetically generated seismic trace. Lateral environments are consequently not taken into account.--

[ Pages 5-6, for the paragraph bridging pages 5 and 6, please substitute the following paragraph: ]

--Furthermore, an image processing method is known from the published DGMK (Deutsche Gesellschaft für Mineralölwissenschaft und Kohlechemie = German Society for Petroleum and Coal Chemistry) Conference Report [1996] "Image Processing of Seismic Attributes and Geostatistics in the Upper carbon" by C. HELLMICH,

# FAX RECEIVED

JAN-28-2003 15:25

COLLARD&ROE

JAN 28 2003

15163659805

P.07

## TECHNOLOGY CENTER 2800

B3  
Gnt

H. TRAPPE and J. FERTIG. This method permits a quantitative characterization of seismic representations and thus further interpretations of the lithology. Different image processing filters are employed to amplitude maps in this process, and the variations, or the continuity, respectively, of the amplitude values of the closer environment are quantified. The filters represent 2-D multi-trace filters, which are used for taking the local environment around a data point into account. Operators employed for this purpose are the entropy and the dispersion, among others. Maps for the interpretation can be generated for the interpretation with all attributes. The quantities "entropy" or "dispersion" are in this respect measures that quantify the variations or continuities of the amplitude in the local environment.--

[ Pages 6 and 7, for the paragraph bridging pages 6 and 7, please substitute the following paragraph: ]

--It has to be emphasized in this context that only relative comparisons in the local environment of a data point are considered in the methods described above. Laterally continuous and gradually changing conditions of the surroundings, for example, are consequently not conspicuous in connection with

## TECHNOLOGY CENTER 2800

B3  
Cond.

these processing methods. Even in connection with the implementation according to claim 19 of WO 96/18915, only a relative similarity, i.e. a similarity based on the individual cell is determined first. The similarity values so calculated are compared with similarity values of a volume with a known hydrocarbon reservoir that have been calculated in the same way, and the well location is determined in the newly investigated volume based on the comparison of the coherency values with the coherency values of the volume of the known hydrocarbon reservoir. However, only coherency values relatively determined in a local environment (cell) are included in the comparison in this case as well.--

---

Page 7, before the second full paragraph, please insert the following heading:

--SUMMARY OF THE INVENTION--.

Page 7, for the second full paragraph, please insert the following paragraph:

B4

--The problem is solved with a method in accordance with the invention.--

---

## TECHNOLOGY CENTER 2800

Pages 7-8, for the paragraph bridging pages 7 and 8, please substitute the following paragraph:

B5  
--If the geological conditions of the subsurface to be explored are known at a location in the region covered by the seismic data volume, for example based on information collected from a well, the similarity of the seismic signals in the entire volume of measured data is determined, using the signal on the location having the known geology. It is assumed in this context that similar geological conditions generate a similar seismic signal in order to transfer in this manner via the similarity determination the geological conditions known in the drilling location to other regions as well, or to find such conditions again there as well, respectively. --

Page 13, before the third full paragraph, please insert the following heading:

-- BRIEF DESCRIPTION OF THE DRAWINGS --

Page 14, before the second full paragraph, please insert the following heading:

-- DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS --

## TECHNOLOGY CENTER 2800

Page 14, for the second full paragraph, please substitute the following paragraph:

B6

--FIG. 1 shows a schematic representation of a 3-D data volume 1 comprising a multitude of seismic traces, which are not shown explicitly. A square stone-shaped section 2 is shown in the data volume 1, with three time series in the form of the seismic trace portions 21, 22 and 23 being arranged by way of example on section 2. The local data section 2 preferably comprises three to seven neighboring traces per lateral direction, for example 5 x 5 traces with a time length of 5 data points (samples) as well, which at a sampling rate of 4 ms thus conforms to a time slice of 20 ms.--

Page 15, for the first full paragraph, please substitute the following paragraph:

B7  
Con4

--FIG. 3 shows the result of a reference analysis as defined by the invention for a geological horizon with a constant lithology. A slice is cut for this purpose from the 3-D data set along the interface of the layer. Based on the well "a" with the ascertained lithological information, a cube-shaped reference



# FAX RECEIVED

JAN-28-2003 15:26

COLLARD&ROE

JAN 28 2003

15163659805

P.11

## TECHNOLOGY CENTER 2800

B7  
Cond

pattern with 3 x 3 x 3 data points (samples) was selected in analogy to the section in FIG. 1.--

---

Page 16, for the first full paragraph, please substitute the following paragraph:

B8

--On the other hand, FIG. 4 shows a less calm lithology for the same analysis region. The layer interface selected in the present case is assigned to a sandstone horizon which represents a potential reservoir for hydrocarbons. Similarity features were calculated based on a reference pattern section derived from the well "a", whereby, according to the gray scale gradation shown on the right, the similarity values are on a distinctly lower level than those in FIG. 3. While high similarity values are found as expected in the surroundings of well "a", differences appear toward the eastern part of the analysis region, which is shown on the map on the right. In the area of lower similarity, the well "b" encountered a dense sandstone that is not suited as a reservoir horizon. It has to be noted here that some of the fault zones visible in FIG. 3 can be recognized also in the range of said layer interface in FIG. 4.--

---